THE

CHEMIST

June, 1959

VOLUME XXXVI

NUMBER 6

Crawford H. Greenewalt Receives AIC Gold Medal

Left to right: Dr. Ray P. Dinsmore, Hon. AIC, chairman, Medal Award Committee; Mr. Greenewalt, and Dr. Emil Ott, Retiring AIC president

(*See Page* 191)

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TO COME IN JULY

Some more of the fine papers presented at our 36th Annual Meeting will appear in the July CHEMIST. Among these are "Research in Government and Industry," by Lt. Gen. James M. Gavin, USA, Retired, executive vice president, Arthur D. Little, Inc.; "The Changing Character of Chemical Research in Government," Dr. Edward Wichers, associate director, National Bureau of Standards; "The Growth of Research and its Consequences to the Economy," Dr. Carl F. Prutton, executive vice president, Food Machinery & Chemical Corporation.

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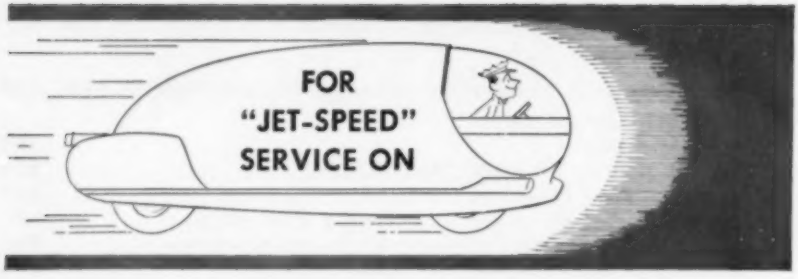

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EDITORIAL

The Thirty-sixth Annual AIC Meeting

Dr. Emil Ott, F.A.I.C.

Retiring President, The American Institute of Chemists, Inc.

OUR Thirty-sixth Annual Meeting, held May 6-8, 1959, in Atlantic City, N. J., turned out to be a new high in achievement. All the activities listed in the program (see April 1959 CHEMIST) took place without any changes. All of the talks were exceptionally good and stimulating, according to the opinions expressed by the large number who attended the meeting. It was a pleasure to see a record number of ladies present, who enjoyed many of the talks as well as the events in the ladies' program.

Such success does not just happen. It is the result of considerable effort and devotion on the part of all the members of committees. We were fortunate in having our Annual Meeting Committees start their activities nearly two years in advance of the meeting. They did much more work over the ensuing period than the casual observer would suspect.

I want to name these Committee chairmen: John Kotrady, as general chairman of the meeting, was interested in coordinating all phases of the arrangements. The Program Committee was headed by two co-chairmen, Dr. Murray Berdick and Dr. Max Bender, who organized our excellent program. Our incoming president, Dr. Wayne E. Kuhn, provided overall guidance. Dr. Joseph H. Dusenbury was chairman of the Committee on Arrangements which was kept extremely busy. Chester A. Amick, chairman, effectively attended to the innumerable details involving the Committee on Registration. Richard L. Moore, as chairman of the Public Relations Committee, took care of press matters with conspicuous success. The co-chairmen of the very successful Ladies' Program were Mrs. John Kotrady, Mrs. Maurice J. Kelley, and Mrs. Richard L. Moore.

The New York and New Jersey Chapters were our hosts this year. George T. Foy, chairman of the New York Chapter, was the official representative of this Chapter. The New Jersey Chapter was represented by its chairman, Dr. Lawrence T. Eby.

I would like to thank personally and on behalf of the AIC each and every one who served on these Committees, as well as all others who assisted in many ways to make this Annual Meeting an event of unusual impact.

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Special AIC Announcements

New AIC Officers

Dr. Wayne E. Kuhn, general manager, Research & Technical Department, Texaco Inc., Beacon, N. Y., is the new AIC president. As former president-elect, he succeeded Dr. Emil Ott, retiring president at the 36th Annual Meeting.

Dr. Milton Harris, vice president, The Gillette Co., Boston 6, Mass., and president of Harris Research Laboratories, Inc., Washington 11, D.C., has been chosen president-elect, to succeed Dr. Kuhn in May 1960.

Dr. Donald B. Keyes and Dr. Sidney D. Kirkpatrick were re-elected as councilors-at-large. Dr. John H. Nair, consultant, Summit, N. J., was elected councilor-at-large. These councilors serve for three year terms, until May, 1962.

Presentation of the Gold Medal

The AIC Gold Medal for 1959 was presented to Crawford Hallock Greenewalt, president, E I. du Pont de Nemours & Company, Wilmington, Del., at the Medal Award Banquet held May 7, at The Traymore Hotel, Atlantic City, N. J.

Preceding the dinner, a reception was held for the medalist, through the courtesy of E. I. du Pont de Nemours & Co., Inc.

The toastmaster was Dr. Emil Ott, retiring AIC president, who presented Mr. Greenewalt with the certificate of Honorary AIC membership. The Gold Medal was presented by Dr. Ray P. Dinsmore, chairman of the Committee on Medal Award and a former AIC president. Mr. Greenewalt responded with an address on "Can U. S. Science Meet the Soviet Threat?" (Read it on page 195.)

The citation to Mr. Greenewalt reads:

"Chemical engineer, business executive, patron of the arts and sciences; effective advocate of independent universities for the education of chemists, and stanch supporter of professional worth and dignity."

Welcome, New Chapters!

Six new Chapters were announced at the 36th Annual AIC Meeting.

The petition to form a Florida Chapter, to include members in that part of Florida lying east and south of the Apalachicola River, was sent in by D. H. Killeffer, P.O. Box 443, Clearwater, Florida.

John M. O'Neill, patent adviser, Legal Office, Detroit Arsenal, Centerline, Michigan, with the cooperation of Herbert F. Schwarz of the Chicago AIC Chapter, secured signatures to the petition for the Michigan Chapter, to include members in the State of Michigan.

Dr. Robert W. Freedman of Pittsburgh Consolidation Coal Co.,

Library, Pa., presented in person the petition to form a Pittsburgh Chapter, to include the area of Western Pennsylvania.

J. E. Magoffin, vice president, Eastman Chemical Products, Inc., Kingsport, Tenn., obtained signatures for the petition for a Tennessee Chapter, covering the State of Tennessee.

Clark E. Throp, president, Fiber Products Research Center, Beaver Falls, N. Y., personally presented the petition for an Upper New York State Chapter, to cover the area bounded by a line from Oswego to Syracuse, East to Utica, northeast through Glens Falls, N. Y., and on to the New York-Vermont border.

James E. Henning of Bjorksten Research Laboratories, Madison 1, Wisconsin, personally brought the petition of AIC members in Wisconsin for a Wisconsin Chapter.

We welcome these new Chapters. Charters will be presented to them at their organizational meetings.

Louisiana Chapter Announces Honor Presentation

The Louisiana Chapter presented its Honor Scroll to Dr. Arthur E. Wood, head, Chemistry Department, Mississippi College, Clinton, Miss., at its meeting on May 5, in New Orleans. Dr. Wood was honored for his "distinguished service to the profession of chemistry and chemical engineering."

Motion Approved in Support of Clinical Chemists

At the 36th Annual Business Meeting, a motion was approved to the effect that the AIC supports the right of qualified clinical chemists to operate clinical laboratories without the supervision of members of other professions. (The wording of the complete motion has been referred to the AIC Committee on Clinical Chemistry, and it will be published in full in an early issue of THE CHEMIST.)

Resolution on Professional Status

At the 36th Annual Business Meeting, May 7, a resolution reaffirming the professional status of chemists and chemical engineers was presented and approved. (This Resolution will be published in full in an early issue of THE CHEMIST.)

New Jersey Chapter Officers

The New Jersey Chapter announces the election of the following officers for the 1959-60 fiscal year:

Chairman, Dr. Joseph H. Dusenbury, Textile Research Institute, Princeton, N. J.
Chairman-elect, Dr. J. F. Mahoney, Merck & Co., Inc., Rahway, N. J.
Secretary, Dr. Ralph Hill, Esso Research & Engineering, Linden, N. J.
Treasurer, Dr. Curt Bamberger, Patent Chemicals, Inc., Paterson, N.J.

Representative to National Council,
Dr. Lawrence T. Eby,
Enjay Company, Elizabeth, N. J.
New Jersey Chapter Councilors
C. A. Amick, American Cyanamid Co., Bound Brook, N. J.
C. L. Ayers, Bourne Chemical Co., Elizabeth, N. J.
Dr. Max Bender, American Cyanamid Co., Bound Brook, N. J.
Dr. D. L. Cottle, Esso Research & Engineering, Linden, N. J.
Prof. R. W. McLachlan, Montclair State Teachers College, Montclair, N. J.
Prof. S. E. Ulrich, Rutgers University, New Brunswick, N. J.
H. F. Wakefield, Bakelite Division, Union Carbide, New York, N. Y.
Prof. E. S. Wallis, Princeton University, Princeton, N. J.

Amendment to the Constitution

An amendment to the AIC Constitution, to permit Associates to vote in elections and on other matters except on amendments to the Constitution, was approved by AIC Fellows in April, in a four-to-one vote. The Constitution is printed in the April 1958 issue of THE CHEMIST. Please change Article II, Section 11, by adding the words in italic, to read:

> SEC. 11. Honorary Members or Fellows shall have the right to vote on all matters, and Members *and Associates* shall have the right to vote on all mattesr except amendments to the Constitution.

In reply to several inquiries, the word "Members" in Sec. 11 refers, not to the membership as a whole, but to our intermediate grade of membership called "Members" (written with a capital M).

Honorary Membership Awards

Dr. John H. Nair, chairman of the Committee on Honorary Membership, announced at the Annual Institute Luncheon, May 8, that the following persons have been selected to receive Honorary AIC Membership during the 1959-60 fiscal year: Dr. Jack P. Montgomery, AIC Charter Member, of the University of Alabama, Tuscaloosa, Alabama; Miss Florence E. Wall, AIC Charter Member, consultant, New York, N. Y., and Dr. Lincoln T. Work, F.A.I.C., consultant and former AIC president, New York, N. Y. The presentation dates will be announced later.

Date Set for AIC Council Meeting

The next meeting of the Board of Directors and the National Council of the AIC will be a luncheon on Tuesday, June 23, 1959, at The Chemists' Club, New York, N. Y. The Board will meet at 11:30 a.m., followed by the Council Meeting and luncheon at 12:15 noon.

The 87th annual meeting of the Manufacturing Chemists' Association will be held June 11-13, at the Greenbrier, White Sulphur Springs, West Va.

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Can U. S. Science Meet the Soviet Threat?

Crawford H. Greenewalt, Hon. AIC
President, E. I. du Pont de Nemours & Company, Wilmington, Del.

(Acceptance address when the author received the Gold Medal of The American Institute of Chemists, May 7, 1959, at Atlantic City, N. J.)

THE practice of conferring honors of various kinds as an inducement to high performance seems to be well ingrained in the fabric of our society, whether it be the bestowal of a coveted award such as this, or the various orders, ranks, and decorations given to mark conspicuous state service, or the modest prizes which spur the schoolboy to greater effort.

In any form it is a recognition that men will strive more if means exist to reward them in some fashion. In fact, that very human characteristic has been a basic concept of our American society. With individual freedom guaranteed, we have made enormous progress in all areas, whether intellectual, spiritual, or material.

In science particularly the accomplishments of the last few generations have been meteoric and far beyond the wildest dreams of the most optimistic prophets of the past century. I am afraid, however, that until the advent of the Sputnik one unhappy result of our prosperity had been the delusion that genius is a monopoly of our own nation and our own people. Like many of our legends, this conviction does not happen to be true.

It has now been 18 months since the Soviet disclosures of successful space experiments startled the world. It is fair to say that the shock this administered to the American nervous system was the most profound it has ever sustained in a scientific way. At the time, there were those who felt that the signal had been fired for an all-out contest in which we should concentrate all scientific effort on a crash program designed to reassert United States supremacy, in space as elsewhere. Others felt that only on a broad front could our own scientific establishment assert itself in its true potential.

Reassessing the scene today, it would appear that we have come through our period of uncertainty very well and have benefited also in the abandonment of any complacency we may have had about the inevitable superiority of American science. We have made some spectacular advances of our own, in space missiles, in energy development, and in the startling physics of Project Argus. We have undertaken agonizing reappraisals, not only of our present position, but of our entire scientific potential.

At the same time, our people have

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manfully resisted efforts to stampede us into hasty experiments which could have greatly weakened our capacity—there was even talk for a time of enacting production controls over civilian goods—and rushing into a full-scale preparedness effort. We have, happily, preserved our educational system against the attacks of the "drop everything" advocates and have substituted for our earlier complacency a searching examination which cannot fail to lead to lasting improvement.

Even though the sputnik furor is behind us and the chauvinists among us have been taught that "my father can't always lick your father," we must be sufficiently realistic to recognize the fact that we are in a hard competitive race. The Russians have openly declared their determination to surpass us not only in our defense establishment but in our peaceful technology, our commerce, and our position in world markets. The question we must ask ourselves is where we stand competitively and what we must do to improve our posture in what may well be a question of ultimate survival.

It seems to me that we must start with the proposition that the percentage of potentially creative individuals is not greater in the United States than it is in Russia or in any other civilized countries. Man's physical equipment varies little from nation to nation and there is no reason to believe that his mental powers are sharply different. Inherent genius knows no geographical restrictions and we have had ample evidence that it exists in every country and in every field of human endeavor.

I do not think that we can rest too heavily on our material facilities or on our existing technological establishment. Obviously the Soviets, by concentrating their effort, can match us in a particular area. Further, with their form of government, they can be indifferent to effects of concentration on activities which from their national viewpoint are less consequential.

The Strength of a Free Society

If we are to compare the competitive position of the two antagonists and to evaluate them in terms of future effectiveness, we must look well beyond the field of science and technology. For what is really involved is the relative strength of the free society as compared with authoritarian power.

When the question is phrased in that way it seems that there can be no shadow of doubt that science in a free society will win over science as it is practiced under state control. Everything we believe, everything we have experienced, has shown us that just as free institutions will prevail ultimately over those of dictatorship, and free men will prevail over slaves, a free science will triumph over a sci-

ence which functions only as an arm of the state.

It must be admitted that authoritarian science can be more readily shifted in direction. A totalitarian state can if it wishes direct an enormous array of talent to a specific problem and perhaps by sheer weight of numbers secure temporary triumphs and advantages. The strength of the American system on the other hand rests not in concentration but in diversity. With us, science has been an independent force existing in thousands upon thousands of laboratories, each serving as an island of initiative, exercising a synergistic influence on all the others.

In a free society, all branches of science move forward together on an unbroken front. I would venture to say that there has been no great advance that was not a synthesis of ideas laboriously accumulated in many different disciplines—a cooperative fusion of many branches of knowledge. Surely this is a healthier and inherently a far more productive system than one in which the direction of inquiry is subject to violent change dictated not by scientific but by political objectives.

It is only proper to admit that our science also undergoes shifts of emphasis over the years as interest swings from one discipline to another. In a free and dynamic environment such changes are not only natural but healthy. For there are fashions in science just as there are fashions in thought and fashions in dress. The interests of our young people will change from one discipline to another due sometimes to progress and exciting discovery, sometimes to the demands of national security, often simply to chance. I have no doubt that recent adventures in space have caused the astrophysicists, the rocket scientists, and the fuel experts to find a pre-eminence they could not have dreamed of ten years ago.

The pendulum of free choice swings continually, but in the main, science as a great compendium of human knowledge has marched along, with each of its disciplines attracting dedicated followers in sufficient numbers to insure its place in the sun. Departments of paleontology and ornithology may get into temporary trouble from time to time, but there will always be paleontologists and ornithologists if human beings are allowed to pursue their various bents. If I may pursue the analogy from feminine fashions, you will recall that sleeves have been long, short, slit, and puffed; skirts have risen to kneecap and fallen to ankle length; waistlines have been high, intermediate and low, but the essential elements of feminine apparel have always been there and the changes have merely served to keep men interested.

In science, similar changes are reflected in the flow of scientific personnel into those disciplines which

seem to offer attractive opportunities. In the free society, this is a natural course. We have seen striking changes within our own lifetimes. In the 10-year period between 1898 and 1907, there were as many zoologists who received doctorates as there were physicists—the ratio is now about one to 100. There were 10 times as many astronomers as there were metallurgists. During the Twenties, the upsurge of the American chemical industry brought a huge increase in the number of chemistry students. Engineering was virtually unknown as a profession until late in the last century and, for a considerable time, it was the civil and mechanical engineers who predominated. When I was graduated as a chemical engineer in 1922, I was something of an oddity —the great rush was still to come. Today, the electrical engineer holds a top rank. We have encouraged people to be what they will, to pursue any course that seemed good to them in accordance with the needs and spirit of the times, and the total scientific effort by and large has retained a sound balance.

I do not doubt that, at the present time, the Soviet state is producing an extraordinary number of people who have been trained in some form of scientific work. Some of the figures which have been cited make one wonder if any other professions are being practiced at all and whether science is quite ready for the onslaught of such masses. Nonetheless, it is clear that the state's emphasis on science has caused it to commit a very substantial fraction of its manpower, undoubtedly including many of very real ability.

It is true that we shall need more scientists, and better scientists, if we are to hold our place in a scientific world. It is probably true that a greatly accelerated program of encouragement and reward would substantially increase our own pool of scientific manpower. But I greatly doubt that a program based on forced and unnatural persuasion or compulsion would be worth the effort and the risk. I would rather rely on the natural process of free choice.

If our society is to survive, the ultimate choice of a career must be left free and it must be as free of artificial stimulus as it is free of coercion. We cannot make a scientist by attempting to convert a potential musician, historian, or business executive. If man could be crossed with the cat, someone has said, it would enrich man but little, yet impoverish the cat. Similarly, if we enlarge our scientific establishment by press-gang methods, however genteel, we will add little to science and, at the same time, weaken all other areas of human activity.

There is, moreover, the same basic interdependence between all intellectual pursuits as there is between scientific disciplines. Any program which

overemphasizes science at the expense of the arts, the humanities, or other phases of life would do the national interest a great disservice. For a society without its quota of poets and philosophers will gain no glory by increasing its complement of scientists. As it becomes less free, the strength deriving from free institutions will already be waning. The human body will bleed to death no matter which artery is severed; so will a society careless of its unity.

Freedom Required for Bold Endeavors

Freedom is a state of mind, but it can become ensnared in the mechanics of bureaucracy and, to the extent that science becomes a state responsibility, it necessarily becomes restricted. Scientific discovery has not always come upon the wings of purely scientific reason. Much as we may admire the Soviet achievements of the past few years, there can be no doubt that, in the long run, the honors for daring and imaginative concepts must rest where men are free and failure carries no threat of personal disaster. The free society alone is hospitable to venture.

Under the authoritarian rule, individuals are loath to get very far out on a limb, and bureaucratic administration all too often demands advance proof before authorizing unorthodox approaches. If American science had been fettered by this short chain, it is unlikely that much would have been accomplished, for bold endeavors are highly sensitive to the atmosphere in which they are undertaken. Where government funds are concerned, the subsidizing of hunches comes hard. Yet it is the risk-taking, based on faith and optimism, which has brought American science to its present state. It has been the entrepreneur quite as often as the careful investor who has financed progress.

The question is not which form of society will win out—it is whether or not we, the architects of freedom, have allowed barriers to arise which restrict our traditional freedom of choice and the incentives which drive us to extraordinary endeavors, and whether the Soviets, having learned their lesson, may not in fact be drifting toward traditional American concepts. Here is the real question—one which in its very paradox may serve to dramatize the danger.

Many recent observers of the Russian scene report the adoption of rewards or incentives throughout the industrial and educational fields. In the early years of their regime when collective rather than individual achievement was the order of the day, performance declined to the point where it became necessary to contrive a whole series of personal inducements which included titles, special decorations, and public accolades. Today, these seem to have been superseded by resort to the very crass, capitalistic emphasis which Marx and

Engels had deplored so vigorously. I have heard the report that a Russian professor of high rank is now paid the equivalent of $30,000 a year at the official rate of exchange and in addition is given relatively excellent housing accommodations, the use of an automobile, a summer home and numerous other fringe benefits. I was somewhat startled to compute that this is about equivalent to my own compensation after federal income taxes.

There seems to me to be considerable irony in the fact that the United States, a free nation, taxes individual rewards at rates reaching 91 per cent, whereas in totalitarian Russia, dedicated to the happy notion "from everyone according to his abilities to everyone according to his needs," the maximum income tax rate is 13 per cent.

Incentives Needed to Inspire Accomplishment

I am afraid, however, that the tax gatherer is not the only villain in the piece. All of us, through carelessness or thoughtlessness, have allowed incentives and rewards in certain areas to sink almost to the vanishing point. No where is this more obvious than in the schoolroom. The Russians have clearly recognized the value of their national objectives of able and dedicated teachers and have been willing to pay them accordingly. In contrast, it seems that on our part we have allowed the compensation of our academic faculties to sink to levels which Mr. McDonald would find intolerable for steel workers.

We have talked endlessly about our need for scientists and about the importance of stimulating our youth to scientific careers. If that is to be more than idle conversation we must insure inspiration and dedication in the classroom, since it is on our teachers that we must rely if the creative talents potentially available in our young people are to flower and bear fruit. All of us have experienced in school or college the thrill of discovery of some branch of human knowledge, brought to us by the inspiration, the eloquence, and the dedication of a brilliant teacher.

There will always be those who will teach for the love of it, but I am afraid that in the long pull, and with the greatly increased numbers our educational establishment will have to accommodate, if we insist on paying workman's wages we will have no better than pedestrian performance in the classroom.

To win in the international sweepstakes we must keep our traditional incentives bright and glowing. We must recognize the fact that the greater the array of incentives the more men will strive, and that for the average person rewards or recognition of high accomplishment in any of its many forms will bring out the ultimate in creativity and drive.

In an experiment lasting over many

generations we have proved conclusively that a free society with incentives and rewards geared to personal accomplishment will produce a nation with a strength second to none. The Russians give signs of having learned that lesson also. Whatever form our economic warfare with Russia may take, I feel certain that we can win only if we return to those principles which have brought us to our present high stature. If we do not, the battle before us will be difficult, the outcome uncertain and the price, measured in human terms, an unconscionable burden upon the future.

About AIC Members

Dr. Frederick W. Zons, AIC Charter Member, was honored with a dinner at The Chemists' Club, New York, N. Y., April 20, by the North Jersey and New York Sections of the American Chemical Society. He was cited for "his contributions to the advancement of the chemical profession and to the development of the New York Section and the North Jersey Section of the American Chemical Society through his conscientious and diligent endeavors as pioneering Editor and Manager of *The Indicator.*"

Speakers were **Dr. Lawrence T. Eby,** F.A.I.C., and **Dr. Walter J. Murphy,** Hon. AIC. **Dr. Edward J. Durham,** F.A.I.C., presented the scroll of appreciation to Dr. Zons.

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Dr. Hans B. Jonassen, F.A.I.C., of Tulane University, New Orleans, La., and **Dr. Louise Kelley,** F.A.I.C., of Goucher College, Baltimore, Md., are among college teachers of undergraduate chemistry to receive Teaching Medals from the Manufacturing Chemists' Association, June 11, at the annual meeting of the Association, at White Sulphur Springs, W. Va.

Dr. Glenn A. Nesty, F.A.I.C., vice president in charge of research and development, Allied Chemical Corp., New York 6, N. Y., has been elected a member of the Board of Directors of the corporation.

Dr. H. E. Robinson, F.A.I.C., vice president in charge of research, Swift & Company, Chicago, Ill., announces that **Dr. Walter M. Urbain,** F.A.I.C., has been appointed director of engineering research.

Robert B. Boyd, F.A.I.C., is now manager, industrial sales, in the Phosphorous Division of Hooker Chemical Corporation at Jeffersonville, Ind.

(*And see page* 231)

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The Importance of New Jersey Industries in the Economy

The Honorable Robert B. Meyner

Governor, the State of New Jersey, Office of the Governor, Trenton, N. J.

(Condensation of an address given at the Keynote Luncheon at the 36th Annual Meeting of the AIC, Traymore Hotel, Atlantic City, N. J., May 7, 1959.)

THE success of the chemical industry is distinctly intertwined with the economy of this State. New Jersey has long ranked first in the Nation in the manufacture of chemicals. The latest Commerce Department survey shows New Jersey ahead of any other state, accounting for 12 per cent of all the value added by chemical manufacture in the whole United States. At the same time, chemical manufacture has been the leading manufacturing industry in New Jersey, adding over a billion dollars annually to the value of raw materials converted into useful products in our chemical plants.

There are more than 850 chemical plants in New Jersey. One hundred of them manufacture drugs and medicines; over 30 make resins and plastics materials; 85 manufacture cleaning and polishing compounds; 57 make toilet preparations. Dyes, detergents, inks, adhesives, textile fibers, oxygen, sulfuric acid, polyethylene, antifreeze to zinc oxide—hundreds of chemicals important to the national economy—are produced in New Jersey.

The facts are equally impressive, measured by the all-important standard of job opportunities. Last year, there were 81,700 chemical industry employees in New Jersey. About 50,000 of these were production workers. The chemical industry contributed to the New Jersey economy one-quarter of a billion dollars in wages to production workers alone. The average weekly wage of chemical production workers was $98.62, 16 per cent above the all-manufacturing average.

The chemical industry's growth rate paces all our industries. More than $265 million have been spent to build chemical plants in New Jersey during the past five years. Signs point to an acceleration in the years ahead.

Fortunately, the industry takes a back seat to no one in the utilization of research and in willingness to invest its own money in its own future. Your industry invests $500 million a year in research and development. The health field illustrates the industry's amazing fertility. A survey shows that 90 per cent of medical prescriptions filled today involve drugs which were unknown or un-

Governor Meyner chats with Dr. Wayne E. Kuhn, new AIC president, during the Keynote Luncheon

available before the Second World War.

The industry's investment in basic scientific research is the highest of any industry. Eighteen new research laboratories in New Jersey testify that this state is not only a leader in chemical manufacture, but in chemical research—where the young scientists graduating from our colleges will find fruitful employment.

New Jersey's manufacturing structure is a closer replica of the Nation's than that of any other leading industrial state. Therefore, the importance of chemistry in this State simply reflects its importance in the Nation as a whole. I illustrate my point with reference to our own experience in New Jersey. Recently Rutgers, our State University, prepared for us a lengthy report titled, "The Economy of New Jersey." It shows that New Jersey, with a variety of assets of unusual value to industry, can look to the future with confidence. If its natural and human resources are properly utilized, it has the greatest growth potential of any State.

The Rutgers study also shows that, though our State had reached a high level of industrial development at the turn of the century, and though it is situated in the Middle Atlantic area which is described as having "a mature economy"—and when an economist says "mature," he generally means senile—it has kept pace in the

ensuing six decades with the amazing expansion of the Nation, and in many phases of industry has set the pace. Since 1900, our State's population has tripled. Since 1950, our population has grown two per cent each year, far exceeding the growth rates of our neighbors. Our labor force has expanded from 758,000 in 1900 to more than two million. Of greater significance is the fact that this labor force includes a high proportion of skilled workers, technicians, scientists and administrative personnel. This diversified pool of manpower will be even more meaningful in future economic expansion.

This is so because, as the Rutgers study shows,

> "The economy of the future in both State and Nation will evolve within a new setting. Three technological innovations of revolutionary nature will provide major opportunities of industrial growth. These are synthetics, automation, and nuclear energy. They provide exceptional opportunities to hitch the State's economy to the driving forces of the future."

These new breakthroughs of old industrial patterns are intimately tied to scientific research for their development and application. They require a sophisticated labor force. And it is precisely here that New Jersey has the jump on most other industrial states. We are well advanced into a new industrial revolution. Two centuries ago, a young Scotsman watched the steam in a teakettle rattle the lid. That was the kernel of the first industrial revolution. Today, thousands of James Wattses are sitting in our laboratories watching new teakettles. Where the first Industrial Revolution substituted machinery on a vast scale for muscle, the second, "promises, on a comparable scale, to substitute machinery for the human brain, not at top levels of course, but in the normal run of the productive process."

We are on the verge of a period of discovery without parallel in history . . . and there is every reason to believe New Jersey will be the industrial research capital of the U. S. It is estimated that expenditures on research and development in this State are close to $623 million or 9 per cent of the expenditure of the entire Nation. We have here 21,700 scientists and engineers (nearly one in seven of a total of 157,000 such professionals in the country's laboratories. With supporting personnel, we can boast more than 10 per cent of the Nation's research employment. Here are the tools. But these advantages must be exploited.

Public policy must now be geared to new conditions. Modern industries have needs basically different from existing ones. Makers and users of automated equipment may have differing personnel and location requirements. And as Dr. Frank Pittman of the Atomic Energy Commission has said, "Every major existing industry

will be affected by the availability of atomic energy." These are some of the reasons why we, in public life, and you, in research and industry, must gear our action to the future needs of the Nation's economy.

Atomic energy for industrial use provides one example of the vistas opening for our continued industrial growth. Already New Jersey ranks fourth in the number of industrial users of radio-isotopes. Proudly we display the world's largest privately-owned nuclear reactor at Plainsboro, built by the cooperative ingenuity of 10 companies. With anticipation we await the outcome of the $34 million thermo-nuclear program at Princeton University. This project, recently declassified by the AEC, will begin preliminary operations next September. If the reactor can be made a reality, the deuterium, which it will produce, could supply 1000 times the present power consumption for one billion years. Ten cents worth of deuterium can supply as much energy as 300 gallons of gasoline. The program is an ambitious one, but it is no longer considered impractical to aim at the moon.

The Nuclear Energy Program For New Jersey

Studies indicate that at least 8 to 10 per cent of industrial firms can presently make profitable use of radioactive materials in their operations and this number is bound to grow. It is our task to plan for this growth and to encourage it as an aid to our economy. We of State government do not fulfill this function, if we merely consider it our duty to act as circumspect observers reporting daily happenings in our State. We must constantly ask, "What are we doing to bring about desirable results?" Therefore, we are putting into operation a "Program for the Promotion of Constructive Uses of Nuclear Energy."

In addition. we are vitally interested in reactor by-products. In this matter we should profit from the experience of the oil industry—their by-products were once considered a nuisance! We have an advantage. We know the enormous value of the radioactive by-products of nuclear reactors. It is difficult to imagine which industry can profit most from the use of radio-isotopes and from irradiation procedures . . . One of the primary objects of our program is to encourage a greater use of reactor by-products in the known fields and to assist in the development of new uses. A journal article recently listed 200 different uses for radio-isotopes in American industry. Sixty-four of these techniques are being employed by 80 companies in plants located in 62 New Jersey communities. This is a good start.

Our plan of action has five divisions: investigation, information, education, construction, and service. An immediate goal is the organization of a non-profit foundation, combining

the skills of industry, research and State government personnel, to help us carry out our development program. Among its activities would be counselling industries interested in the application of atomic energy to their manufacturing processes, especially the smaller industries that are not in a position to afford the necessary studies for introduction of atomic processes. This would be accomplished by the pooling of scientific information of atomic experts in various fields, much on the same basis that doctors give time at clinics. New Jersey industry has an important contribution to make to the advancement of nuclear science. Through the proposed foundation, the State Government can assist in this advance to the benefit of industry, the State and the Nation.

With limitless opportunities, we are nevertheless faced with the necessity of grappling with a multitude of difficult and often exasperating problems. One such problem is now behind us. In the not-too-distant future the Nation will face a water shortage brought on in part by the booming industrial expansion. In some places, the lowering of the water table is already a matter of concern. Blessed with an abundant supply of rainfall, we in New Jersey have anticipated this problem. Last November a $45 million bond issue was passed to construct reservoirs at Round Valley and Spruce Run and for a survey of water resources in South Jersey.

Problems Posed By Automation

The problems ahead are formidable but never insoluble. Let me mention one. A few years ago automation and the development of atomic energy were regarded as practical problems for the next decade, not for this one. Things have happened far faster than most qualified observers expected. Today automated equipment can process raw materials, assemble the parts, correct its own errors, reject or rework parts that do not meet specifications, and even inspect the finished product.

With atomic energy and automation together, the factory is no longer tied to a traditional power or labor supply. Industrial relocation may be encouraged because it tends to be more economical, even in many cases necessary, to install automation and atomic generation in specially designed new plants rather than in old ones. These facts suggest industrial decentralization and plant shifts and the emergence of many social and community problems arising out of plant abandonment.

Some say automation will put a premium on technical skill and upgrade the labor force all along the line. Certainly nationwide employment, in terms of the number who hold jobs, is rising, but the productivity of our factories is rising so much faster, thanks to technological advances, that the yearly additions to

the labor market are not being absorbed, and so unemployment, too, is on the rise. *Life* magazine has said, "The United States may be able to produce and consume at boom-time levels yet still have a 'permanent reserve' of unemployment which may increase."

Past experience suggests that technological innovations lead in the long run to an expansion of employment by creating increases in other areas. But lest we relax too much in our responsibilities, let us remember the words of J. M. Keynes, "In the long run, we are all dead." It now appears that employment opportunities are not keeping pace with man-hour productivity. We aim for a satisfactory combination of higher output and shorter man-hours without unemployment.

For the present, we must do all in our power to help those uprooted by forces beyond their control or understanding, some at advanced years, to a satisfactory readjustment. This requires from industry advance notice of changes, full explanation, and every aid possible in relocation. It requires from government adequate temporary compensation and retraining aids to ease immediate problems. But in the final analysis, the greater part of the burden for readjustment will fall on neither industry nor government alone. But with both working together, a drastic overhauling of our educational institutions will be needed to reduce the unskilled to a minimum, if necessary by new teaching techniques and facilities, "to provide the technicians for the new day; to train the servants of the new leisure, and to enhance the nation's capacity for leisure as opposed to idleness." Then, we may be faced by a more perplexing problem, posed by a well known writer, "Are we capable of developing a culture that does not depend upon work to give meaning to our lives?" We all need a sense of responsibility in the face of this tremendous advance.

Engineers Joint Council, New York 18, N. Y., reports that freshman engineering enrollment has declined markedly for the first time in 8 years. Enrollment in 1958: 70,029 engineering freshmen, a drop of 11.1% from 1957.

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The Chemist and the World Economy

Dr. R. H. Rowntree
Chief, Economics Division, Export-Import Bank of Washington, D. C., Washington 25, D. C.

(Presented at the 36th Annual AIC Meeting, at Atlantic City, N. J., May 7, 1959)

I

THE chemical industry is a major force in our nation's economy. Fifth among our largest manufacturing groups, its output during the last two decades has grown more than twice as fast as overall industrial production in the U. S. The annual value of chemical products exceeds $24 billion, and is made up of about 11,000 compounds produced in 12,000 plants by more than 820,000 workers. The industry is investing about $500 million a year in research and development, comes up with some 400 new products a year, and is growing so fast that it has to find about $1.5 billion of new capital each year from new investors.

The situation abroad is not unlike that here at home. The chemical industries of the U. S., Britain, and Germany are the largest in the free world, and chemical production in the last two has grown at twice the rate of industry generally.

Assessment of the Soviet chemical industry is difficult but there are recent clues. A nation's production of sulfuric acid and of plastics sometimes is used as an indicator of the size of its chemical industry. The Russian output of sulfuric acid in a recent year was about 1/5 of that in the U. S., and Soviet production of plastics was at 1/8 that of the U. S. level.

The United States leads its next competitor, Japan, by four times in the production of sulfuric acid. In caustic soda Russia is next to us at 1/6 of our output, and in soda ash at 1/3; in superphosphates Japan is second at 1/5; and in nitrogenous fertilizers, West Germany follows us at 1/2 of our production.

Growth of the chemical industry abroad is the result in part of foreign investment by U. S. companies. Exclusive of pharmaceutical facilities, the industry has invested some $500 million in foreign plants and stands better than sixth among all industries in its overseas investment.

II

Now let us consider the future of the chemist in the world economy. What is likely to be the outstanding event of the next 25 years? Will it be new products? Thousands of new products will be developed by the industry and hundreds of new plants will be built to produce them. But this will be only a continuation of the events of recent years.

Will the outstanding characteristic

be the development of automatic plants? Last month a business magazine carried an article describing such an event, and indicated that a computer was placed in fully automatic control of a polymerization unit in a Texas refinery.

Or will the event be one which, originating outside the industry, nevertheless will have far-reaching effects within it? To rephrase the question in a different way: What may well be the greatest threat in the next 25 or 50 years to the welfare of mankind and the peace of the world? Will it be the spread of communism? Will it be atomic warfare?

There is reason to anticipate that it might be neither of these, but rather may be the explosive effect of too many people in the world.

In 1900, world population stood at a mere 1.5 billion persons, although man as a species has been on the earth for perhaps 100 million years. In 1925, the population reached 1.9 billion, and in 1950, 2.5 billion. This was an increase of 2/3 in 50 years. Nearly all modern forecasts of population growth have proved to be too low. However, let us see what the best estimators now foresee.

In 1975, world population will be 3.8 billion (a doubling of the total in 50 years); and in the year 2000, about 6.3 billion. Why is this speed-up in growth taking place and why may it pose so serious a problem for all of us?

In the simplest terms, two-thirds of the world's people live in under-developed countries, and it is in these areas that spectacular declines in death rates are occurring. It is in the under-developed countries that living levels are lowest and that the growth of population is most rapid because of the advances made by medical science. The countries where the greatest ballooning of population is expected—the poorer countries—are precisely the wrong ones to have it. Their share of the world's people will rise from the present two-thirds to over three-quarters by the end of the century. Although traditionally a marked rise in the level of living of a people has been followed after a time by a decline in birth rates, this adjustment may not occur soon enough to solve the impending problem.

What are the effects of a population explosion likely to be? The nations most deeply involved will hardly be squeamish about the means adopted to meet such an emergency: Revolutionary policies may be expected from the ever larger numbers forced to attempt survival on a smaller and smaller per capita share of the world's resources.

Will these revolutionary policies mean the wider adoption of communism? Or an intensified pressure for international migration? Or the attempt to expand territorial limits by the use of force? Or will they involve concerted efforts to reduce birth rates

or to raise levels of living? We all hope peaceful and democratic solutions can be found, but where may they be sought?

It seems likely that chemists and the chemical industry may play a significant role in helping to solve this problem. Consider the possibility of development of an effective, reliable, and cheap contraceptive pill. Regard the effect of some means of cutting sharply the cost of producing fertilizers in the less-developed countries. Contemplate real break-throughs in means to provide really low-cost power, or inexpensive substitutes for basic metals, or other far-reaching developments for which several first steps already have been taken.

III

What we really are exploring here are means of raising significantly the mass-consumption level of the inhabitants of the less developed half of the world. I know of only two basic ways to reach this goal. One is redistribution of income, but it is no real solution to talk of redistributing a per capita income of $50 or $100 a year. Thus the only way really to increase total consumption is through expansion of the total amount produced.

To produce more, productive capacity must be increased. This can be done only through the continued accumulation of capital — that is, through savings. But the historical record indicates that to achieve each 1% increase in the annual rate of growth in a nation's capital, about 5% of its gross national product must be saved each year.

This is not an easy goal for an under-developed economy to attain. Moreover, when the population in such an economy is increasing at the rate of 2 or 2-1/2% a year, this means that 10 to 12% of the country's GNP must be saved merely to stand still. This much new capital is needed just to keep per capita output from falling. In order to start to get ahead, it may be necessary to save twice as much.

This is not too encouraging an answer. Today's inhabitant of an underdeveloped country—and this means *half* the world's population—is likely to say the procedure is too slow. It will not put much more food in his stomach, or clothes on his back, or give him much of a house to live in during *his* lifetime.

We may consider one further possibility. All of the saving required need not be done by the under-developed portion of the world. To the extent that the economically developed countries continue to make foreign investments, the less developed countries can expand now and pay later.

Foreign investment may take the form of equities (stock purchase), or loans, whether public or private. It has long been U. S. policy to assist greater foreign investment of private capital, for several reasons. The in-

vestment of private capital abroad—such as the $120 million by Monsanto Chemical Co. during the past 5 years—provides the plant and equipment to produce more goods and also provides the technical and managerial know-how. The investment is not just so many dollars or so much equipment. It also carries training in how to use the machines. Best of all, it carries abroad a working example of our free-enterprise system—the best export we have.

Although private investment abroad recently has been going on at an unprecedented rate—over $2.3 billion last year—a large part has gone to the developed areas. These regions have the largest markets. They have more adequate sources of labor, many raw materials, and adequate power. They have more stable governments and more familiar legal systems. So, the great outflow of private investment has not been of as much help as we might wish in solving the problems of Asia, parts of Africa, and Latin America.

What have we left? Public investment, plus public guaranties of private investment abroad. These activities, furthermore, may be carried on by national or international agencies.

IV

Why is public investment needed? To finance development projects, such as roads and harbors, normally outside the private sphere; to hasten the establishment of industries — steel mills or chemical plants — which eventually will be taken over by private investors as financial success is demonstrated; and to provide essential foreign investment on long repayment terms when private capital is not itself prepared to do the job.

Several of the agencies engaged in this work are international. Oldest and best known is the 12-year old International Bank for Reconstruction and Development, or World Bank. This agency, owned by 68 different countries, makes loans to its members to finance the foreign exchange costs of transportation, power, irrigation, and similar development projects where 15 or 20 years may be required for repayment. Allied with it is the newer International Finance Corporation to make more risky investments in industrial ventures in less developed countries. Finally, there is being created by the 20 Latin American Republics and the U. S. an Inter-American Development Bank whose function will be much like that of the World Bank but on a regional basis.

The U. S. is a principal source of public funds for foreign investment on a national basis. Here three agencies of the government may be mentioned; The International Cooperation Administration, the Development Loan Fund, and the Export-Import Bank.

The ICA (and its predecessors) is primarily concerned with matters of mutual security and defense support

in friendly countries. However, it also provides guarantees against losses, due to certain "political risks," on new investments abroad of private U. S. capital. The DLF is a relatively new agency which took over from ICA the responsibility for assisting financially the economic development of less developed countries when other sources of loan financing are unavailable. The DLF is engaged primarily in making "soft loans," dollar loans often repayable in the local currencies of other countries, since by definition many of those countries are in too difficult a situation to be able to repay in dollars. Finally, there is the Export-Import Bank, oldest and most successful institution of them all.

Eximbank is a corporation which celebrated its 25th birthday last February 12. It is its purpose to assist in financing the foreign trade of the U. S., provided, first, its loans have reasonable assurance of repayment, and second, its loans do not compete with private capital.

The Bank's $1 billion of capital stock is held by the Treasury. In addition, it is authorized to borrow from the Treasury, provided the Bank pays interest, up to $6 billion additional at any one time. During its 25 years the Bank has made loans of more than $10 billion, of which $3.3 have come due. Only $2,900,000 has been written off as losses thus far. Having paid interest and dividends to the Treasury, and having covered its administrative expenses and other costs, the Bank has accumulated undivided profits of $528 million as a reserve against possible future losses.

This is a good record for any financial institution in the international field. I hope that you as taxpayers, and so stockholders in the Bank in a sense, approve of a public agency that performs its function at a profit. As the chairman of our Board of Directors likes to say: After being in business 25 years, the Bank has only 235 employees altogether, and so must be regarded as a prize bureaucratic failure.

Much of the Bank's financing consists of credits to permit the purchase in the U. S., on long terms, of machinery, equipment, and related services for the construction abroad of transportation and power facilities and of plants to produce ores, steel, textiles, chemicals, etc.

Now I shall connect these remarks with our title, "the chemist and the world economy." Whenever a company, U. S. or foreign, wishes to build a new chemical plant abroad or expand an existing one; intends to obtain the equipment from U. S. suppliers, and wishes financial assistance from the U. S. Government in connection with the project, it may ask the Bank for help.

This help may take the form of a dollar loan from the Bank, or of a guaranty by the Bank that some pri-

vate lender of the funds will be repaid when the due date arrives. The assistance may also take the form of a loan from the Bank of the local currency required to secure such items as land, bricks, and labor in the host country, provided the Bank has such currencies available for lending. The source of these funds is the sale in certain countries abroad, for local currencies, of agricultural surpluses from the U. S.

In the past about $150 million of dollar credits have been authorized by the Bank for the chemical industry abroad, and some loans have been made in local currencies. This is only a small part of the new investment that has been made abroad by private capital in this or other fields of industry. But this is as it should be, since public funds should not be expected to take the place of private investment. Nor can public funds alone be expected to resolve the problem of raising quickly enough the level of living in under-developed countries. Even private investment cannot do this job alone; the peoples in the countries concerned must themselves play a major role in providing solutions to the difficulties that lie ahead for all of us.

The chemist in his laboratory or in his plant, whether here or abroad, has only begun the great role he may play in the next generation. Whether or not he will prove to be one of the stars in the show, or merely will have a major supporting role, he surely will contribute in significant degree to solving at least one of the major problems which mankind is about to face.

The Society for Applied Spectroscopy invites papers on Emission and X-Ray Spectroscopy, Mass Spectroscopy, Infrared and Ultra-Violet Absorption, and Gas Chromatography, for a meeting on November 4-6, 1959, in New York, N. Y. For information: Dr. M. F. Wilson, program chairman, Air Reduction Corp., Research Lab., Murray Hill, N. J.

The National Aluminate Corporation, Chicago 38, Illinois, has changed its name to Nalco Chemical Co.

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The Chemist and National Defense

Major General Marshall Stubbs

Army Chief Chemical Officer, Department of the Army, Chemical Corps, Washington, D. C.

(A slightly condensed version of a paper presented before the 36th Annual AIC Meeting, Atlantic City, N. J., May 7, 1959)

"In this complex era of unprecedented technological progress and of intricate political problems, the future belongs to those who refuse to be awed by its difficulties and resolutely accept its challenges."

THIS statement was made by Army Chief of Staff General Maxwell D. Taylor to members of the Association of the United States Army at its annual meeting last October. He said further:

> "The over-all objective of the Army, today and for the future, is to contribute to the security of the Nation as a member of our tri-Service team by providing ready forces for sustained land combat in any type of conflict, any place, any time."

Chemists will have a lot to say and do about the Army's ability to provide such forces. They will also have a lot to say about whether the Navy and Air Force can meet these challenges on the sea and in the air.

Dr. Murray Berdick, inviting me to speak, stated that one of the objectives of your association is to "cooperate with all the agencies serving chemistry to make the professions of chemist and chemical engineer powerful factors in the advancement of intellectual and material progress in the United States of America."

You already have in great measure achieved that objective. You are without question a powerful factor in the intellectual and material progress of our country. You are also a powerful factor in the defense of our country . . .

We had ample evidence of the importance of chemicals to national security in World War II. You would be called upon for even greater contributions, if there should be another war. Since the last one we have become more dependent upon the technological developments that emerge from your laboratories . . . It is possible that through chemistry we may eventually succeed in making war impossible, or at least highly unprofitable for aggressors.

A Large Order in a Small Package

Army research in chemistry and other sciences is directed toward increasing the amount of firepower that can be brought to bear on the enemy, with the fewest number of men, in the least possible time, with least amount of hazard to our troops, and with the least amount of effort. That

is a large order in a small package. It involves flexibility of movement, logistics, ordnance, protection, communications, transportation, and energy. Chemistry figures in all of these. If we provide all of these things in a high degree of technological perfection to our troops, what would a Space Age soldier look like?

A concept of this super-trooper of the future has been vividly described by Major General Harry W. Johnson, the Army's chief for combat developments. He said that all of the proposed Buck Rogers-like equipment that he described had been found completely feasible by Army officials.

The Space Age soldier will be wearing clothes for protection against any kind of attack. He will go over obstacles and jump ditches with a boost from a rocket belt strapped on his back. He will move almost effortlessly with the aid of zero ground pressure creeping boots. He will carry a light, all-purpose super gun and 150 rounds of ammunition. He will wear headgear equipped with a tiny, individual radio, effective at ranges over 1000 yards. The helmet will have a removable front panel, which, when in place, will protect him against chemical, biological, and radiological attack.

If the soldier needs shelter in a hurry, he will strip a pencil-like automatic foxhole digger from his suit, ram it into the ground, detonate it, and jump into the hole it creates. He will travel in air jeeps—saucer-like vehicles which can move easily in any direction or hover motionless in space. He will eat of irradiated food, carried in a small, flat pack.

This concept is not far-fetched. Some of these things are just around the corner. Others are in the prototype stage. We do not yet have the zero ground pressure boots and some of the other more imaginative devices, but I believe in the principle that what a man can conceive, he can achieve.

The Need for New Power Units

The Army is conceiving new needs every day. The Army is in constant search for new and bold solutions to the problems it must solve in an era of rapidly advancing science . . . More than ever the Army depends upon its ability to move, shoot, and communicate. To do these basic things it must have power in a small, rugged package. This is a major problem. It may be that chemistry will help us find the answer.

The battlefield in the next war will be spread out and in constant motion. Troops will have to keep moving and be well dispersed. This necessitates reliable methods of communications which will not be dependent on telephone wire. We will need new and better power units to power such communications — compact power packages which can be moved around the battlefield quickly. They must be rugged, reliable, lightweight.

Batteries may provide a solution to this problem. Real progress is now being made in this hitherto neglected field. The Army's intense interest in the development of more efficient batteries is revealed in the fact that the Army Signal Corps alone has nearly 20 research projects underway. It is looking for major breakthroughs in primary batteries which will make them more suitable for low temperature operation. It is conducting research on nuclear batteries and associated materials to lead to the development of portable batteries utilizing radioactive sources.

The Army has a big stake in the development of fuel cells. The Ordnance Corps, Corps of Engineers, and Signal Corps are working together in this search for a new energy source. The fuel cell is not a new development. Interest in fuel cells was generated over 150 years ago in an effort to find means of burning coal electrochemically in a battery at a higher degree of efficiency than possible with conventional heat engines. There are difficulties to overcome, but there are some recent promising developments.

If successful, this new energy source may help dispel a major problem of logistics. Gasoline is still the best fuel for use on the battlefield, but since 60% of the tonnage required for combat operations is in fuels, we must seek something better. Even in the last war supplying gasoline to our field forces was a major problem, and the cost of delivering it to the point of use can be expensive. Fuel loads for tanks are figured on an 18-hour running day. The quality of present fuel will not always allow tanks to run at full power. Medium tanks and some trucks are being converted to diesel fuel as an interim source. While this reduces to 50% the amount of fuel consumed, efficient and compact fuel cells would change the picture entirely.

Dr. Roy W. Johnson, director, Advanced Research Projects Agency, Department of Defense, has stated, "there is much work to be done across the board in the energy field." From the Defense Department's and the national point of view, the need for power systems from watts to megawatts is foreseen. Some of these, he said, will be chemical, some solar, some nuclear and other types. In all of them low weight, long life, and good efficiency are needed.

New Ideas Wanted

Most of the Army technical services —Ordnance Corps, Signal Corps, Medical Corps, Corps of Engineers, Transportation Corps, Quartermaster Corps and the Chemical Corps either have active chemical programs reaching into every crevice of chemistry, or are dependent upon chemical developments by industry. Many have major problems in the field of chemistry.

In the Corps of Engineers, chemistry plays an important role in the study of surface tensions and adhesion

of ice and snow in the Arctic and Antarctic regions. In the construction of runways, Army Engineer chemists seek to solve the problem of iced runways, to improve runway uses and flight operations. They seek a better method or improved material to reduce ice conditions on airfields in the polar regions. Experiments are also being conducted to determine whether, with the addition of certain gases, snow can be made into a more pliable building material.

The Engineers have long sought means whereby wet, weak soils can rapidly be rendered sufficiently strong to support the emergency operations of military vehicles and aircraft. Chemicals that are able to release atoms from the crystal lattice of the soil minerals and make them available to participate in the formation of a cementious compound have been tested and show some promise. Such chemicals are being studied both as primary stabilizers and as secondary additives in conjunction with conventional inorganic cements. As yet no completely satisfactory stabilizer systems have been developed and this field is wide open for new ideas. If you have any, the Engineers will welcome you with open arms.

Transportation Corps has no working chemists and conducts no research work in chemistry. It has the full advantage of such work conducted by other agencies of the Army where it may have application. However, the products of industry used in the Transportation Corps depend in heavy measure upon chemistry. Chemistry played a role in the development of the Transportation Corps' Rolling Fluid Transporter. Utilizing an extremely low-pressure, "tire-like" container as the bulk fluid carrier, the transporter consists of a series of 500-gallon capacity containers mounted as duals on an axle and towing assembly, which can be towed in multiples behind any vehicle capable of traversing the terrain involved.

Chemistry fulfills a major role in the operation of the Quartermaster Corps, which develops new or improved foods, clothing, equipment, and supplies to promote the effectiveness of the combat soldier. The Corps maintains a strong, continuous program of basic research, directed toward the discovery of new knowledge, principles, and theories which may be blended into applied research and development.

Chemical treatments and compounds are used to develop supplies and equipment designed to protect the soldier against enemy weapons, battlefield hazards, and extremes of weather. Chemistry is used in the development of special protective clothing for special occupations, such as fighting fires and handling fuels used for guided missiles. Chemistry has application in the development of materials to contain and carry liquid fuels under temperature extremes,

and in research for better materials to cushion air-dropped military supplies. Chemistry supports the program to improve the variety, acceptability, packing, packaging, and serving of military rations.

The Quartermaster Corps also is interested in the development of chemical fuels to heat rations in the field. Studies are being made to determine the effects of new methods of food preservation on packaging and containers, and to investigate biochemical reactions which may be utilized as a basis for new food processing techniques.

The Army Signal Corps is concerned with many problems in its never-ending search for better communications and related equipment. The areas of chemistry of special importance include ultra-pure materials, energy conversion and crystallization through super-pressures and super-temperatures.

The Army Chemical Corps lives on chemistry in all of its forms, and has many top flight chemists and chemical engineers in its laboratories. One part of our research work is concerned primarily with substances that affect bodily mechanisms in varying degrees. We also must develop methods of protection against such substances.

The area of toxic chemical warfare has been full of question marks, during and since World War II. While it has not been used since World War I, we cannot rest complacently on the assumption that it will not be employed. In the present race of technological supremacy in the science of warfare, we are better off if we assume that we must prepare for the several known means of effective warfare. This is not only for our own protection but as a deterrent to aggressors.

We strive for a constant input of ideas, both from within the Corps and from industry, universities and research organizations. We need new and novel ideas that are applicable to our field, and we want them before they have been laboriously perfected. While not all will prove fruitful, failures must be accepted as part of the program. If we wait until we can be sure, we may have waited too long. We must close the time gap between the birth of an idea and its translation into reality.

One of our problems is to so equip our fighting men that they would be impervious to a chemical and biological attack, yet be so unencumbered that they could effectively continue their mission.

We are concerned with developing more adequate and more rapid early warning systems to detect a chemical or biological attack. Since many chemical and biological warfare agents cannot be detected by the senses, it is imperative that simplified methods be devised that would warn us early of such an attack.

We are aware of the recent devel-

opment of physiologically active materials that might be used by an aggressor to stifle the will to fight of his opponent's armies. We must have your cooperation in studying this development.

We run into many complex problems in our search to give our troops complete protection. For example, complications arise when man attempts to protect his skin from toxic agents. Plain sweat is a problem. Any protective barrier interferes with the evaporation of sweat. Substantial effort has gone into the development of a clothing material that would prevent penetration by toxic agents and still permit the evaporation of an adequate amount of sweat. We are assisting the Quartermaster Corps in the search for a practical material. Considerable success has been achieved in protection against certain agents such as mustard gas by impregnating ordinary permeable clothing with reactive substances in such a way that heat loss by evaporation is hampered to only a slight degree, but we have newer problems to solve.

The Chemical Corps is working with the Quartermaster Corps in the search for lighter body armor materials that will give a higher degree of protection. Research must look toward more protection against conventional weapons as well as flash and radiation from nuclear weapons.

A recent chemical industry publication estimated that 50,000 compounds are prepared and studied by chemists every year. Most will never get out of the laboratory. I should like to put in a bid for these compounds that do not get out of the laboratory. The Chemical Corps is avidly interested in the things that you find in your laboratories that may have no immediate use. We must be especially alert to study materials that an enemy can use to produce physiologically adverse effects.

Information Sought

We are in the process of perfecting mechanisms by which more direct approaches may be made to the laboratory sources from which we may be able to obtain the help we need. It is possible that representatives of our Industrial Liaison Office at the Army Chemical Center may have been in touch with you. Approximately 450 of the nation's 3000 industrial and institutional laboratories are now cooperating in our efforts to tap available technological help. But we need all of them.

Here are some general areas of information we must study:

(1) Adverse physiologically active compounds including those having a high degree of effect; and those having a marked convulsant, sedative or incapacitating action with a lesser degree of effect.

(2) Compounds which have therapeutic or prophylactic value. This group covers the whole range of interest concomitant with the effects of chemical warfare agents.

(3) Those substances, compounds or mixtures having specialized properties such as: gelling, thickening, incendiary, decontaminating and smoke producing.

(4) The detection of chemical warfare agents and nuclear radiation and the protection and decontamination of personnel or material exposed to their effects.

The information received from industrial laboratories is protected with the utmost care. All rightful interests of participants in the program are respected to the fullest degree, including all patents rights.

You can strike a quick blow for national defense by your contributions to this program. If in your work you have an idea that may aid in our search, or if you run across something which may fit in with our program, we will be indebted if you will let us know about it.

Defense today is a scientific business. This reliance upon chemistry and many other sciences extends not only to the Army but to all branches of defensive effort. In addition to your direct contributions to National Defense there is another way in which you can contribute. A strong chemical industry is one of our best defenses. You are helping to build up our potential for defense by being strong yourselves. It is imperative that you be strong, that you develop the most productive know-how, that you have the best technology in the world, and that it be kept alive and forward-looking . . .

We cannot stockpile all the things we need. We cannot stockpile technology in the sense that we can place it on the shelf and leave it there. Technology can get old just as shelf-items succumb to the aging process. What is new today may be obsolete tomorrow in this fast-moving world. These are things you know. The chemical industry is alive and growing and should we be forced into another war, we can take hope that we have such strength at hand.

The American Academy of Arts & Sciences, 280 Newton St., Boston 46, Mass., announces that a Monograph Prize of $1000. is available in Physical and Biological Sciences. Details may be obtained from the Committee on Monograph Prizes of the Academy.

Engineers Joint Council, 29 W. 39th St., New York 18, N. Y., is now the sponsor for the United States Committee on the International Association for the Exchange of Students for Technical Experience (IAESTE).

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Beckman Scientific and Process Instruments Division, Fullerton, Calif., recently demonstrated, in New York, N. Y., "The Megachrom," as "the first commercially practical preparative gas chromatograph," making it possible to fractionate and collect samples of ultra-pure materials in volumes 100 times larger than with existing chromatographs.

Optics Manufacturing Corp., Philadelphia, Pa., is featuring a semi-automatic slide projector, the "Opta-Matic". One of its key features is a housing made out of Marlex high-density polyethylene, with a lifetime guarantee.

American Education
Meeting the Soviet Challenge

Dr. William E. Stevenson
President, Oberlin College, Oberlin, Ohio

(Presented at the 36th Annual AIC Meeting, at Atlantic City, N. J., May 8, 1959)

AS president of the College which first, throughout the world so far as we can discover, granted degrees to women on the college level, I am impressed by the large number of young women who are involved in higher education in Russia and the high proportion entering medicine, engineering, research and other professions, usually reserved for men.

This is a challenge to be taken seriously if we wish, as we must, to utilize our brainpower, human resources, and abilities to greatest advantage. Certainly we must not let traditional male prejudices prevail over logic and common sense. In this country we have yet to test fairly and adequately the help which can be furnished by women in almost any field, but in science and scientific research in particular.

True, women, like men, do get married, but unlike men, many of them do have to take time off for childbearing and child rearing. If this interruptive difficulty is being solved in Russia and elsewhere, I cannot believe that, in the face of shortages of scientists, engineers and research experts and the availability of thousands of intelligent and qualified women, American creativity cannot work out a constructive pattern to solve this problem. Women's potential contribution is illustrated by a young lady who graduated from our college eight years ago. A chemistry major, she entered industrial research and has already become the part inventor of a new patented product which has been featured in extensive and highly successful advertising.

Certainly the stress in the Russian educational program on mathematics, science, language and on exacting standards is highly commendable. It should encourage people who believe in raising academic standards and goals for our students. I doubt if we have even begun to develop the intellectual powers of our citizenry in terms of the potential. Here, friendly competition in methods and techniques of training from other countries may well prove stimulating and helpful to us.

Yet, in making comparisons with other systems of education, we must be cautious in accepting data from abroad without comprehensive analysis and understanding. In studying the Russian educational system, we

must bear in mind its rigidities and its authoritarianism, which tend to encourage conformity and standardization and thus to discourage and minimize, in many areas, creativity and the development of new concepts and ideas.

So, also, in making statistical comparisons between our two countries we must not forget that in Russia the great mass of the people are receiving at the lower levels of education very inflexible and uniform instruction which terminates for most of them after ten years or earlier. Up to that point, standardization rather than individuality among students has been the practice. It is only at the university level that outstanding students are culled out for advanced training to become an important part of an elite group which, obviously, should be superior in competence when compared to our university students—a group which is rapidly becoming a substantial part of our total population.

We must give great credit to our Russian friends for having upgraded the status of scientists, research experts and educators generally. This is a comparison which is much to our disadvantage, disclosing, as it does, a lack of public recognition, here at home, of the importance of culture, intellect and the sphere of the mind.

Finally, Russia appears at her very best in the area of education and scientific research where greater individual freedom is found than in most other spheres. Yet the universities and technical institutions are all subject to autocratic direction by State officials and for whatever purposes the State considers important to its development and political welfare.

We Americans have been prone, although with a grudging willingness, to acknowledge that some other nations may possibly surpass us in certain "minor" accomplishments. We are willing to admit that there are generally better ski jumpers in Norway, pearl divers in Japan, or woodcarvers in Switzerland, but when a country like Russia, which traditionally has been regarded as "backward," presents clear evidence that its educational system is capable of sensational achievement in fields where we have believed ourselves, perhaps mistakenly, to be supreme, we are startled, annoyed, and not a little confused.

The Answer to the Challenge

Surprised as we are by Russian accomplishment, it would be a mistake to believe that the American answer to Sputnik is simply a larger, faster, higher Sputnik. It would be a mistake merely to dance to the tune which Mr. Khruschev plays. He has stated the Russian goal—a socialist-communist society for our grandchildren and for the whole world. For us to attempt only to do everything Russia does, but a little better, would be to acknowledge Khruschev's foresight.

We should not minimize the challenge presented to us by the educational systems of other peoples. But if a neighbor has raised a bumper crop of corn, we need not abandon our orchards, or gardens, or wheat fields in order to produce more, but probably poorer corn than he has. Rather, we should improve our husbandry everywhere, with deliberate speed, but never in panic.

If we were talking about a football game between Russia and our country, we would be justified in analyzing the Russian offensive strategy and then deploying our available manpower and strength to block any Russian forward passes or end runs and hopefully to move our own offensive deep into Russian territory. But, unfortunately, the contest between Russia and our own country is not a mere game but a cold war. Our opponents espouse a political philosophy which candidly and repeatedly emphasizes world conquest at its ultimate goal. In the meantime the Soviet leaders go through the motions of co-existence and purport to espouse the kind of friendly relations which we seek and prefer.

If this analysis is correct, then the task of our country in general and of its educational system, in particular, is not so much to concern itself with matching or excelling the aims and objectives of Russia, but rather to re-appraise and to re-assert our own aims and ideals and then to do all we can to see that they are realized. We have placed our bets on the democratic way of life and on the state as the servant, rather than the master, of its people. Unless we betray or abandon that historic commitment—which is unthinkable—we must continue to take the risk, a cooly calculated one, that the principles of democracy ultimately will prevail throughout this world, and that, conversely, tyranny, autocracy and oppression of the individual will and must become intolerable and obsolete. In other words, we must have faith in right, rather than in might.

Many Russian techniques and accomplishments seem impressive, commendable and worthy of study. There are undoubtedly things which Russians are doing in science, technology, specialized research and education which we can observe and perhaps imitate to our advantage. But we will be making a tragic mistake if, in our eagerness to prevail in the competition with the Soviet, we let our democratic aims and purposes become diverted or subverted by expedients which are only reconcilable with a totalitarian way of life. Perhaps you recall the limerick:

> An epicure dining at Crewe
> Found a fat mouse in his stew
> Said the waiter, don't shout
> And wave it about
> Or the rest will be wanting one, too!

We Americans must be wary of wanting all the things which our Russian friends are waving and shouting about. The struggle between us will

probably be a tough one and a long one and, therefore, calm, farsighted, patient, rather than impetuous, decisions and actions are called for on our part.

Our Finest Asset

We must not underestimate the achievements of other people in other lands, and where it is desirable to emulate or to surpass these we should by all means do so, but the mission of America is a mission of free men. We are blessed with an asset not given to any other nation in the whole history of the world—millions of healthy, intelligent, imaginative, and energetic young people. They are the raw material for the most advanced civilization ever known—our real "massive retaliation." If we fail them they can become a mass of pathetic nonentities, responding dully to whatever stimulus is applied, lost in an unfriendly world they do not understand. They are hungry for our interest, our wisdom, and our affection, and they have an enormous capacity for growth and accomplishment. The day-to-day necessities of life, the search for which bore down so heavily on earlier generations, are available to them more easily than ever before, and they are being set free to pursue exciting new adventures in human relations.

We can provide for these dynamic young people all manner of buildings, laboratories, libraries, tools and gadgets, and we can instruct them in their use. So can the Russians. But all we can honestly give them is an example —a non-institutional, non-organized, completely personal example. We cannot shunt them into schools, colleges, day camps, nurseries, clubs, and later into corporations, companies, military units, or labor pools, alone, and expect to reap anything but a whirlwind. Far more than this is required.

There is no doubt that our problems of education will mainly be solved—and the battle for our concept of civilization will be won—not in committee rooms, or by state legislatures, or even at PTA meetings, but rather in our own homes. Here, and only here, will our children, under the patient, affectionate, intelligent, day-to-day guidance of their parents, be made ready for school, for college, and for the stern but rewarding tests of life. It is home and family influence which can most effectively engender in our young people wholesome intellectual attitudes and motivation, self-assurance and stability, a balanced sense of social responsibility and, most important, a scale of spiritual and moral values which is relevant to the pressures and problems of present day living.

In contrast, I see no evidence that Soviet leaders are encouraging Russian students to understand the sum total of life, nor that their present leaders would permit their people to live with reference thereto. The Russians are making a great show of

teaching young people how to do all manner of things. It does not appear that their students are expected to understand why. Russian education is an instrument of national policy in a nation whose long-range objectives and code of values are rigidly established by committees in the Kremlin.

We should make a grave mistake, if we were to abandon or compromise the great governing principles of American democracy, of real legal order, of moral values, and of the primacy of each individual person, to pursue the devious Russians along any path whatsoever. The standards by which we live must be established here in America, not in Moscow. We pray for friendship with all people; we cannot afford to buy it by sacrificing principle.

The Need to Define Our Educational Objectives

The real challenge to American education lies here at home. It is not primarily related to anything Russia has done or will do. Our most urgent task is to examine, evaluate and, hopefully, upgrade our educational system; to decide upon our objectives, and to see to it that they are arrived at. We need at the outset a better understanding of the difference between good and evil; between purposeful work and pointless activity; between real wealth and material goods, between freedom and self-indulgence, between liberty and license.

We need higher standards of performance, not based upon the demands set down by a boss or professor, but upon every man's deep desire to do a job which he will be proud of and his fellows will appreciate. Our children need the sincere, personal attention of responsible adults—good examples of lives well lived for the young to emulate.

With all the marvelous means of mass communication at our disposal, it is disturbing that so many of the hero-images best known to our young people are flabby nonentities, euphoric "nice people" so contented they can hardly stand it, or grotesque caricatures of "good guys and bad guys." Even our legitimate heroes are, with a few notable exceptions, only those who are the most competent and successful operators of our fantastic machines.

Under our system of democratic free choice we are entitled to all manner of golden calves for ourselves and our children if we want them—along with shoddy goods and shoddy ideas which encroach insidiously upon our culture. There should be plenty of room in our society for a sympathetic tolerance of youthful foolishness and room for mistakes, but when foolishness becomes acceptable as a cultural standard and we become unable to distinguish what error is, we have cause to worry.

There is no need to explore into our contemporary idiocies, some of which are so wasteful of precious hu-

man resources as to anger a saint. It is enough to remind ourselves that if our standards are low, if our children are being deprived of thorough, well-administered education, if we are becoming satisfied with levels of performance dangerously below the best, we have only ourselves to blame.

Our first job is to determine what our educational objectives are to be. In a country which thrives on community projects, we have the opportunity for a nationwide community project bigger than any other peacetime project we have ever tackled. We need the combined wisdom of all our citizens. We need responsible, forceful leadership, from the center of national government in Washington down to every local school board —leadership which an enlightened, interested citizenry will follow, not blindly but critically and creatively.

We need from our leaders a ringing reaffirmation of America as an ideal, a beacon of hope and promise in man's struggle for self-realization. We need urgently a renewed zest for an understanding of the fredom we profess. America ought to be the world's best example of a free society of free men. The American experiment in self-government, less than two centuries old, is under massive attack by destructive, alien forces, guided by narrow, selfish men who do not want the American dream to come true. Under such deliberate attack our once sturdy code of values totters; our defense of freedom becomes confused and uninspired.

The basic question before us is whether freedom is justifiable; whether we have enough sense of responsibility to bear its heavy burden and the requisite vigilance to protect it; whether as a nation we are capable of living under moral law, of which man-made laws are only a reflection. The answer to these fundamental questions will determine the basis for our educational system. The government cannot provide the right answers; only individuals can do that.

Our future, as Americans and as human beings, depends upon our success in educating ourselves. Thomas Carlyle, writing in England more than 100 years ago, said, "America is here or nowhere." Unless the American experiment works, here and in our time, it will be a millenium before mankind is likely to have similar opportunity for responsible, personal freedom.

If our first job is to understand our fundamental educational objectives, our next is to see that we do everything possible to reach those objectives.

The Need for Public Support of Education

We need far more public support for our educational institutions than we have had since America's earliest days, when the schoolmaster, ill-trained and threadbare though he may have been, was one of the most

honored men in the community and the education of a child called for the utmost material sacrifice.

The federal government, together with philanthropic organizations, corporations and individuals, is taking useful, encouraging steps toward solving education's financial problems. They are faltering steps, far from adequate for the crash program that needs to be done. We do not seek nor want universal federal government subsidy of the total education program, as Russia has. A basic and important part of the challenge is whether Americans are willing and able to support their free institutions.

Local school boards need to stop petty squabbling over picayune details and personalities. School bond issues must be approved, schools built and adequately staffed. Teachers must be given proper respect and authority, both to teach and to govern their pupils. Pupils must be given enough work—the most capable more than those of lesser ability. A pleasant, harmless mediocrity is not good enough for the children of America.

Since the human mind is the instrument involved, schools should do vastly more than they are doing to stimulate independent thinking, even at the risk of offending some of our burgeoning special interest groups. There is a place in school for healthy social development; physical education, and athletics, but let us stop using valuable classroom time in training baton twirlers, organizing pep rallies, or decorating the gym for next week's prom.

Some American schools are doing outstandingly good jobs and are striving to do even better. Others are distressingly negligent. James B. Conant, in *The American High School Today*, said:

> I am convinced American secondary education can be made satisfactory without any radical changes in the basic pattern. This can only be done, however, if the citizens in many localities display sufficient interest in their schools and are willing to support them. The improvements must come school by school and be made with due regard for the nature of the community. Therefore, I conclude by addressing this final word to citizens who are concerned with public education: Avoid generalizations, recognize the necessity of diversity, get the facts about your local situation, elect a good school board, and support the efforts of the board to improve the schools.

The Need for Adequate Financial Support

One of the most discouraging flaws in the American educational system is found in higher education. Happily, it is a flaw which a reasonable amount of wisdom, coupled with good will and common sense, can correct. I mean the failure of the people of the U. S., individually or through corporations, foundations or other organizations, including government agencies, to give adequate financial support to the colleges and universities.

Some important progress has been made, but not enough. It is outrageous that college and university administrators, even faculty members, must spend so much time and energy begging for money, from state legislatures, corporations, foundations, alumni, parents, and from anyone who might have an extra $100. What is now only a trickle of funds to support education must increase to a steady flow. No college which by its past performance deserves decent facilities, adequate salaries for its faculty and generous scholarship resources for worthy students, ought to be deprived of them because of neglect by a wealthy, prospering nation.

The constant asking for money, which almost every college and university has to do, has a debilitating effect on the whole educational process. Investment in the education of its young people is by far the soundest, most remunerative, most satisfying investment a nation can make. It is high time that those who enrich themselves through use of the talent pouring out of our colleges and universities think more seriously about paying substantially for the cost of producing this talent. It would be my hope that this INSTITUTE and its distinguished members would take ever greater leadership and responsibility in seeing that there is adequate support for those colleges and universities in which education is taken seriously and standards are high.

The Kind of Education Needed

There is need for our colleges and universities to offer the kind of education which will meet our ultimate objectives and which will merit widespread, generous public support. There is room in America for a wide variety of institutions, from the sprawling, multi-unit university to the smallest training institute, and there are people who will profit by instruction in all of them.

At the heart of our educational system is the liberal arts college—the college of arts and sciences—where the overall success or failure of American education will be determined. Here is the source of future dynamic leadership—in science, literature, business, the professions, government. Here the future chemist sits down with the poet; the architect with the philosopher; the teacher with the congressman. Their lives intermingle; they learn to understand themselves and each other; they will never become isolated from their fellow men.

A good American liberal arts college is a microcosm, out of which may come every human resource the greater world will ever need. A future president of the U. S., whose decisions in time of crisis will affect all our lives, may spend this afternoon playing baseball on the campus of a liberal arts college; a future Nobel prize winner, whose scientific discovery will benefit mankind forever, may have

just cracked a beaker in a laboratory on a liberal arts campus; a composer whose songs the whole world will some day sing, may spend this evening rehearsing with his college orchestra.

The liberal arts college is an American phenomenon; it is not found in Europe. No institution has been devised, however, which so well suits the mood of America, nor which points the way so clearly to realization of the American dream. It is an institution created by and for free men and women in a free society.

It has been pointed out that the largest, most impressive and most expensive building in the Soviet Union is a university, the 36-story, $300,000,000 University of Moscow, and that this signifies Russia's devotion to education . . . We in America could, with our know-how, build the world's largest ocean liner in the middle of Kansas. It would be most impressive, and significant of our high regard for ocean liners. But it would be a long way from the ocean.

Is it not possible that Moscow's towering, monolithic university is a long way from the sea of truth and freedom across which every bona fide university must find its way? Educational progress and development in Russia may seem impressive and worthy of note. But the truly significant challenge to this country is not any Russian challenge but that challenge which we offer to ourselves.

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The Winterbottom Industries, Ltd., of Manchester, England, comprising some 17 affiliate companies, announce the appointment of **Dr. Allan R. A. Beeber,** F.A.I.C., vice president of Arkwright Finishing Co. (one of the American affiliate companies) as the technical representative in the U. S. for the English companies.

Dr. Emmett B. Carmichael, F.A.I.C., of the University of Alabama Medical Center, Birmingham, Ala., presented the Gorgas Scholarship awards to four students, in March. The Alabama State Science Talent Search is sponsored by The Gorgas Scholarship Foundation, Inc., in cooperation with the Alabama Academy of Science and several colleges.

Dr. Schrade F. Radtke, F.A.I.C., director of the Expanded Research Program of the American Zinc Institute, announces that a new AZI and zinc industry sponsored project, to improve zinc lithographic printing plates is in progress.

Paul B. Slawter, Jr., M.A.I.C., vice president, G. M. Basford Co., N. Y., and **Dr. Robert Heggie,** F.A.I.C., vice president, director of research & development, American Chicle Co., New York, N. Y., participated in the symposium, "Selling Professional Services," held by the Association of Consulting Chemists and Chemical Engineers, Inc., in New York, March 10. **Richard L. Moore,** F.A.I.C., Chemical Public Relations, W. R. Grace & Co., served as moderator.

John S. Rovey, F.A.I.C., has been appointed vice president in charge of sales of the Chatas Glass Co., Vineland, N. J.

Davis R. Dewey, II, F.A.I.C., president of Baird-Atomic, Inc., Cambridge 38, Mass., announces that the firm has purchased Atomic Associates, Inc., of New York, and Atomic Associates, Inc., of California; Atomic Accessories, Inc., and Atomic Development & Machine Corp., both of New York.

A consulting firm in the textile field has been formed by Dr. Eugene W. K. Schwarz and Henry C. Speel, as Schwarz, Speel & Associates, 101 W. 31st St., New York 1, N. Y., affiliated with Skeist & Schwarz Laboratories of Newark, N. J. Associate consultants include **Dr. Irving Skeist,** F.A.I.C., polymer chemist, and **Preston R. Smith,** F.A.I.C., specialist on asphalt and tar products.

Harry M. Zimmerman, F.A.I.C., general manager, Plastics Division, Seiberling Rubber Co., Akron 9, Ohio, announces that Donald E. Wolff has been named technical service manager for the division.

Dr. George L. Royer, F.A.I.C., administrative director, Central Research Division, American Cyanamid Co., New York, N.Y., has been elected to the board of directors of the Industrial Research Institute, Inc., New York 17, N. Y.

Dr. Ulric Bray, F.A.I.C., president, Bray Oil Company, Los Angeles 63, Calif., announces the appointment of Dr. M. Z. Fainman as director of research.

Professional Obligations of Chemists

Dr. Emil Ott, F.A.I.C.

Vice President, Research & Development, Chemical Divisions, Food Machinery & Chemical Corp., 161 *E. 42nd St., New York* 17, *N. Y.*

(Presented before AIC Chapters during the author's term as president of The American Institute of Chemists, Inc.)

CHEMISTS are interested in "Professional Status" on the one hand and the responsibilities and obligations related thereto on the other hand. The subject has been discussed many times, yet there continues serious interest. It is likely when this kind of situation exists, that we have a profound philosophical subject connected with fundamental issues. But perhaps there is also confusion on certain aspects of the subject. These would be sufficient reasons to have a discussion meeting. Other reasons for group discussion are that:

(1) The individual is forced to make an accounting of his position.
(2) The individual is given an opportunity to review his position with others, and
(3) The group may be stimulated to concerted thinking and action.

Perhaps a good way to begin is with a review of the meaning of the words "profession" and "professional" within the framework of this discussion. The dictionary definitions of what would apply and interest us are:

Profession: (*a*) An occupation, if not purely commercial, mechanical, agricultural, or the like, to which one devotes oneself: A calling in which one professes to have acquired some special knowledge used by way either of instructing, guiding, or advising others or of serving them in some art: as the profession of arms, of teaching, of chemistry.

(*b*) The three *professions* or *learned professions* is a name often used for the professions of theology, law and medicine.

Professional: (*c*) Characteristic of or conforming to the technical or ethical standards of a profession or an occupation regarded as such, as *professional courtesy;* his action was not *professional*; distinctly *professional* work.

As we well know, the very old professions in the fields of medicine, law and theology have been singled out as The Professions. They have "professional" standing. Other fields such as the activities of chemists are included in the broader definition, and accepted today. Nevertheless, the setting aside of the three so-called "learned professions" of the physician, lawyer and clergyman is not fully accepted by all chemists. It may pay us to examine this further.

The three learned professions deal with recognized basic needs of the individual in regard to body and soul, health and happiness, and also with man's interrelationships with other men in a given society, or the concepts of ethics. The practitioners in

these three fields have vested authority as well as a duty to serve their fellow men with dedication. They must serve at times without remuneration, and without regard to person or class. Their individual economic welfare is meant to be of secondary importance.

It is these concepts in the fulfillment of basic human needs that have given these professions their high standing. It is obvious that not all members of these professions are serving with equal devotion and selflessness. Some members in these three "learned" professions are engaged in their work on account of the high remuneration possible. This, however, is a secondary issue, and has nothing to do with the basic principle. It is the "code of ethics" of these professions that any practitioner, including those financially most successful, must at times serve the poorest and at times the least worthy, irrespective of personal likes or dislikes. Thus, every true physician must attend a sick person irrespective of financial status when called upon to do so. The lawyer must assist the dregs of society in order to assist the performance of justice. The clergyman must give spiritual help to any human in need, whether he be of his particular faith or not.

Another aspect of the "learned" professions is that they are self-regulated. Training at university level is required and certain standards of professional competence must be met. Only those who have passed a system of examinations will be admitted or allowed to be recognized as official practitioners. Thus, service and maintenance of a given system and standards is a main issue.

It is logical that other activities which have the basic ingredients of service and dedication to the welfare of the individual or a given human society will also be called *professions*, when certain standards of university level training are satisfied. Thus we speak of the professions of teaching, the profession of arms, the professions of engineers and chemists, the profession of the press, the profession of politics (in the constructive sense). Many chemists and engineers are concerned with this specific concept and hence emphasis is given to proper training and licensing, as well as the establishment and maintenance of codes of ethics.

This approach, however, does not satisfy all chemists. The roots for this are to be found in the fact that most chemists, in common with most scientists, are not interested primarily in tradition and maintenance of a given system, and services in that area.

Rather, they are interested in progress, through the production of new scientific knowledge and understanding. This kind of progress destroys certain traditions by new approaches and facts, and leads to the building of a new world, or, in other words, *creative effort*. It is this creative produc-

tion, and its application, which has made our civilization what it is, with the obvious benefits to human society. They are responsible for the new world in which we live.

This indeed is a service to mankind in the deepest sense. It is, however, different from the contribution of the before-mentioned three professions, in that it is relatively new and its benefits are not specifically personal and not necessarily obvious to the average person; nor does the average individual necessarily recognize the need therefor. This service nevertheless meets all of the standards of the learned profession in that it satisfies a basic human need, namely, development upward from lower standards and toward a freer and fuller way of life. While many of the contributions are of material aspect, no one can successfully deny that civilization has flourished only where material standards were high.

The foregoing does not mean to deny that some individuals attain spiritual leadership without material possessions; that some physicians are working for progress in the development of new methods through research; that some clergymen are profound philosophers working for deeper understanding, broad in scope; that some lawyers are visionary and helpful in the creation of advanced judicial systems.

It simply states that most members of the learned professions are maintaining a high level system based on the fruits of research and human advancement, whereas most chemists and other scientists are primarily engaged in the advancement of the frontiers of our material and mental world. I do not want to analyze or justify the statement that our civilization is what it is because it owes its advances and advantages to science and its applications. The fact that nearly every woman can dress like a queen, and every man can eat like a king; the reduced impact of diseases and the miracles of modern transportation, would not be possible without the work of the chemists. Nor have they done this work alone. Engineers and other scientists have made their tremendous contributions.

From the standpoint of satisfying a basic human need, the freeing of mankind from its physical shackles, they have, and are indeed still performing in ever-increasing rate, a service of the highest order. Some are well paid; some are not. But most are working with devotion and dedication. True, there are variations as there are variations in the learned professions. But there can be no question that chemists are true *professionals* in the best and deepest sense.

This concept is an integral part of the working philosophy of the AIC.

Thinking about these matters, one realizes that this very service which we are giving impells us to fulfill additional obligations.

We have been given privileges in that we have been permitted to study at universities. We have been allowed to learn, under the guidance of masters, some of the secrets of nature. We have been allowed to learn of research and to fall in love with the challenge of the unknown. The training which we have received has been financially supported by the society in which we live. It is our obligation to give back to our society whatever we can. Obviously we must do this in the manner to which we have been educated.

One of the duties we have is that we must maintain and further our education to high levels, so that our effectiveness does not decrease. Not all of us may be privileged to continue in strictly scientific lines, and some of us will embrace other activities of human endeavor such as managerial activities, teaching, counseling, and the like, but we must keep growing. This is our *obligation* to justify the privileges to which we have been exposed.

Since we know of the value of chemistry for mankind, we must make sure that mankind understands the meaning of our contributions. This we may call *professional recognition*. We must work for it by assisting the press by various means. We must do this not for self-glorification, but because it is in understanding and acceptance of our professional work that we will be more meaningful to the society in which we live, and to which we feel obligated.

We must help shape the means to make the soil more productive, to make the production of meat products more economical. So, figuratively speaking, we must shape plow shares for a rapidly growing population. But we must also shape the weapons which our civilization and our country needs to defend our valued position.

Knowing of the importance of chemistry, we must assist our youth to become interested in its study, and we must give assistance to education through various means which will insure that our proper man and woman power will be developed in this field of vital learning. The motivation for creative work springs from the individual. This flame may be kindled and may be made to grow through stimulation, but not by rules and regulations. Ours is a dual problem, the dedication to a cause, *and* inspiration to create. To help kindle this flame wherever we see a spark—to nurture this dedication wherever we see its beginnings—is one of our *professional obligations*. It is of interest to note that the obligations discussed here are in the Constitution of THE AMERICAN INSTITUTE OF CHEMISTS, under "Objectives."

Truly, we have an opportunity to be the light of our society. We must see to it that we are worthy of this enviable place in our social structure.

It is not recognition *per se* which we must seek, it is *giving* which we must practice. By and large we have met these obligations satisfactorily, but none of us would say that we cannot do better. Though I elaborate on details, the important thing is that the basic understanding and attitudes be clear. With this done, each one of us will know what his particular tasks will be in regard to his *professional obligations.*

I am not one to pretend that I live up to the highest of my professional obligations, but I would be remiss in my duties if I were not to recognize the need of doing these things. This may sound like a sermon, but how can we discuss obligations, if we do not relate them to our convictions and creed.

Knowing what is basic, we can easily find some ways and means to work in the right direction. It is not necessary that we do all that is possible, but it is certainly necessary that we do some. It is my conviction that we chemists are at a very vital spot in our civilization's structure. We are privileged for this position, but consequently, important obligations are firmly placed upon us.

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The University of Michigan, Bureau of Industrial Relations, School of Business Administration, Ann Arbor, Mich., held a Seminar on Engineers' and Scientists' Opinions of Collective Bargaining for Themselves, May 14-15. The Bureau of Industrial Relations has just published "Administration of Salaries and Intangible Rewards for Engineers and Scientists," by Prof. John W. Riegel (209 pages, $6.00).

Reprinted

The paper by Dr. Foster Dee Snell, Hon. AIC, on "The Independent Consultant and Independent Laboratory as a Professional Activity," (THE CHEMIST, April 1959) is being reprinted in *Your Consultant,* publication of the Association of Consulting Chemists and Chemical Engineers, Inc., New York 17, N. Y.

Communications

Training Programs for Chemical Technicians

To the Editor:

I note with considerable interest the quotation from Randall Meyer's talk on the value of technicians (THE CHEMIST, May 1959, p. 153).

There are now some two dozen colleges in the United States and Canada that offer two-year programs for the training of chemical technicians. These curricula comprise well-organized sequences of chemistry, mathematics, physics, English and cultural subjects. The young men and women who are graduated from these colleges are competent in chemical techniques and skills and have generally been well received by the chemical industry.

They work as assistants to chemists and chemical engineers in laboratories and in plants, and generally furnish trained assistance to the professionals.

—Dr. Lewis R. Fibel, F.A.I.C.
Dean of Students
New York City Community College

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One Way to Increase Professional Status

To the Editor:

The following statement appeared in *The Del-Chem Bulletin,* April 1959, page 14:

> ". . . at the request of physicians the Washington (D.C.) papers had recently adopted a policy restricting use of 'Dr.' to physicians, dentists, and ministers."

I have checked the accuracy of this statement . . . and found it to be correct. This alarming action by the Washington papers may have resulted in part from the suppression of the use of earned academic degrees by the American Chemical Society. Even last September, the ACS Committee on Professional Relations unanimously recommended to the ACS National Council the adoption of a policy to indicate the highest academic degrees of authors on all ACS publications and in news items. The ACS National Council endorsed this, but the Board of Directors over-ruled it . . . This matter was again considered at the ACS National Meeting in Boston; it remains to be seen what will be the outcome of the deliberations. . . .

What motivates such suppression of earned professional rights? Indeed, why are such "deliberations" necessary in connection with a self-evident right duly bestowed by accredited universities? . . .

Colleges and universities grant de-

grees "with all rights, privileges and honors to that degree appertaining," by virtue of the powers vested in them by State Legislatures . . . The wording of the diploma of an M.D. or D.D.S., is exactly the same as for the Ph.D., D.Sc., D.Eng. Any newspaper yielding to pressure tactics by certain groups to uphold one doctorate and deny others is acting ignorantly . . .

The public is beginning to recognize the contributions of scientists and engineers for the betterment of living . . . The myth that medicine alone is the pinnacle of higher education is vanishing; in far too many cases it is the lesser paid chemist, biologist, physicist, whose efforts culminate in the discoveries of new drugs, antibiotics, isotopes. The public must know this.

I propose that the AIC take appropriate steps to eliminate the gross injustice done to scientists and engineers when their academic degrees are omitted by the press. Action should be precipitated jointly with other professional organizations . . . In addition, the matter should be called to the attention of universities which grant doctorates. Individual AIC members should be alert for such omissions by publications which accord academic titles to physicians, dentists, and the clergy.

This insistence on the use of earned academic degrees is one way by which the professional status of chemists and chemical engineers can be elevated in the eyes of the public.

—Dr. Stephen D. Bruck, F.A.I.C.
Wilmington, Delaware

Likes "Chemical Books Abroad" Column

To the Editor:

. . . "Chemical Books Abroad" is an interesting and valuable part of THE CHEMIST and I personally would like to see it continued. We all have trouble keeping up on the chemical literature these days, especially that originating abroad, and Dr. Seiden's column certainly helps to make this job a little easier.

—Dr. J. D. D'Ianni, F.A.I.C.
Akron, Ohio

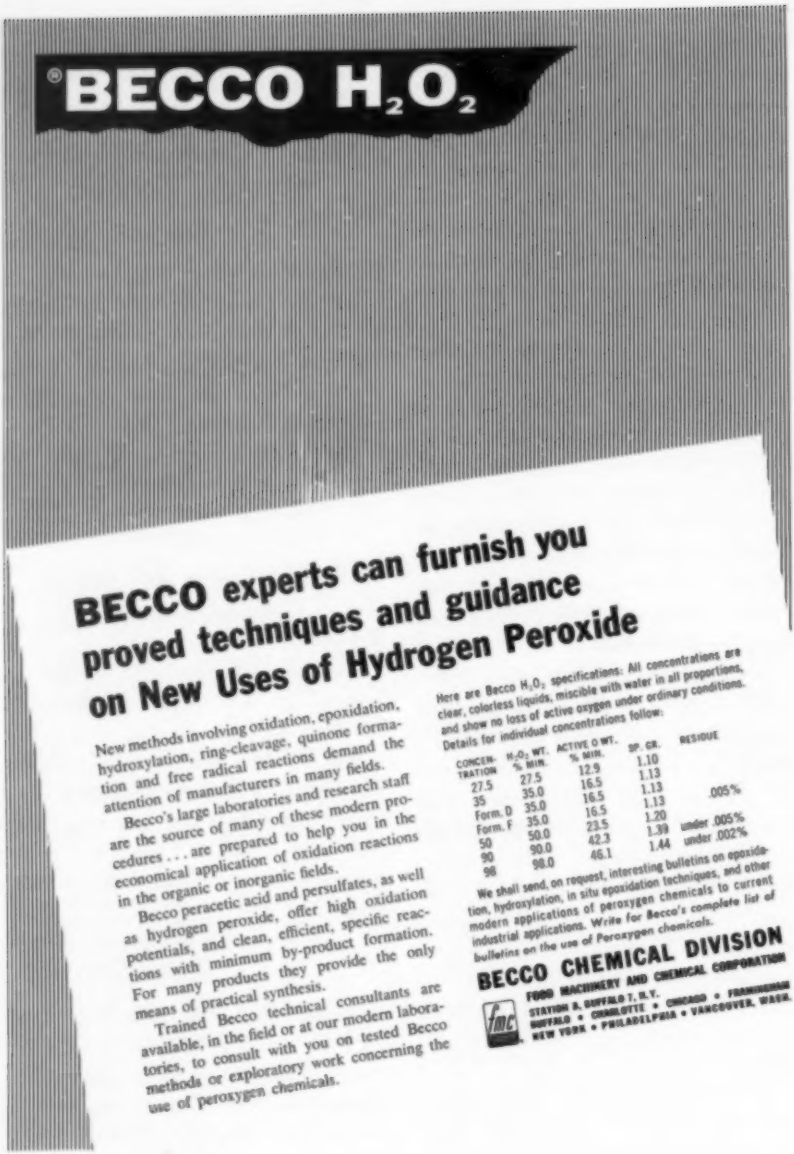
Finds Code of Ethics Praiseworthy

To the Secretary:

For your information I became interested in The American Institute of Chemists from reading your publication, THE CHEMIST. My reason for wishing to become associated with this group is becausue I strongly feel that your Code of Etnics is a truly praiseworthy contribution to our profession.

—Donald G. Slavin
Philadelphia, Pa.

Arthur D. Little, Inc., is publishing "Kelvin Scale", a news sheet of current information on cryogenics and related subjects. Copies may be obtained from The Editor, *Kelvin Scale*, 20 Acorn Park, Cambridge, Mass.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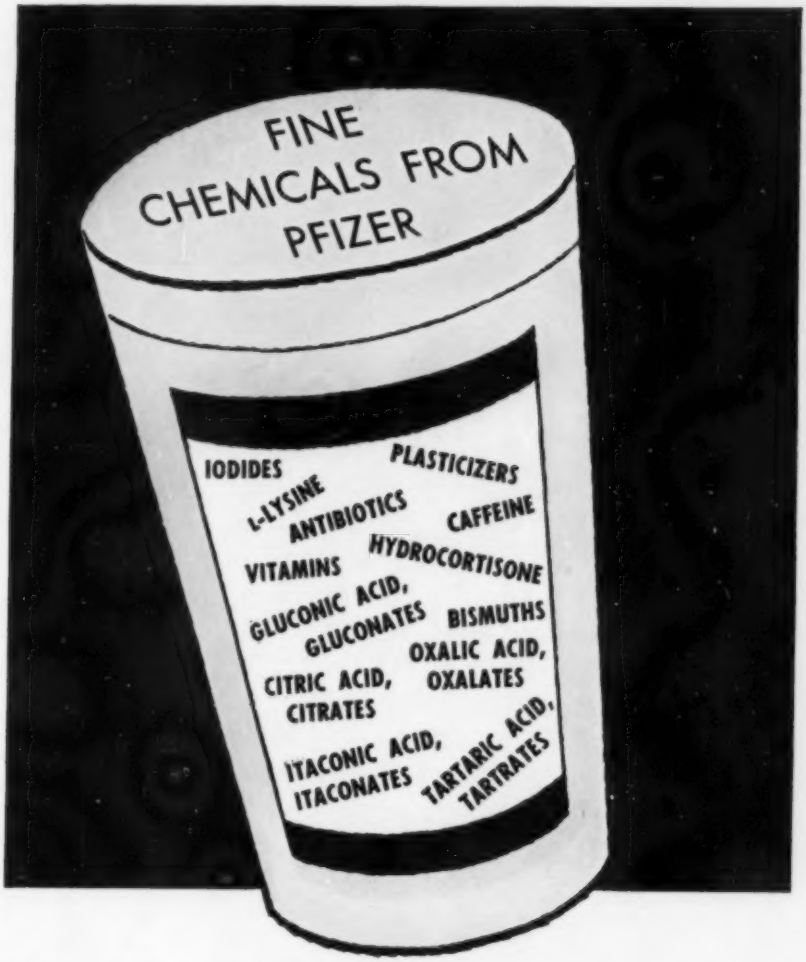

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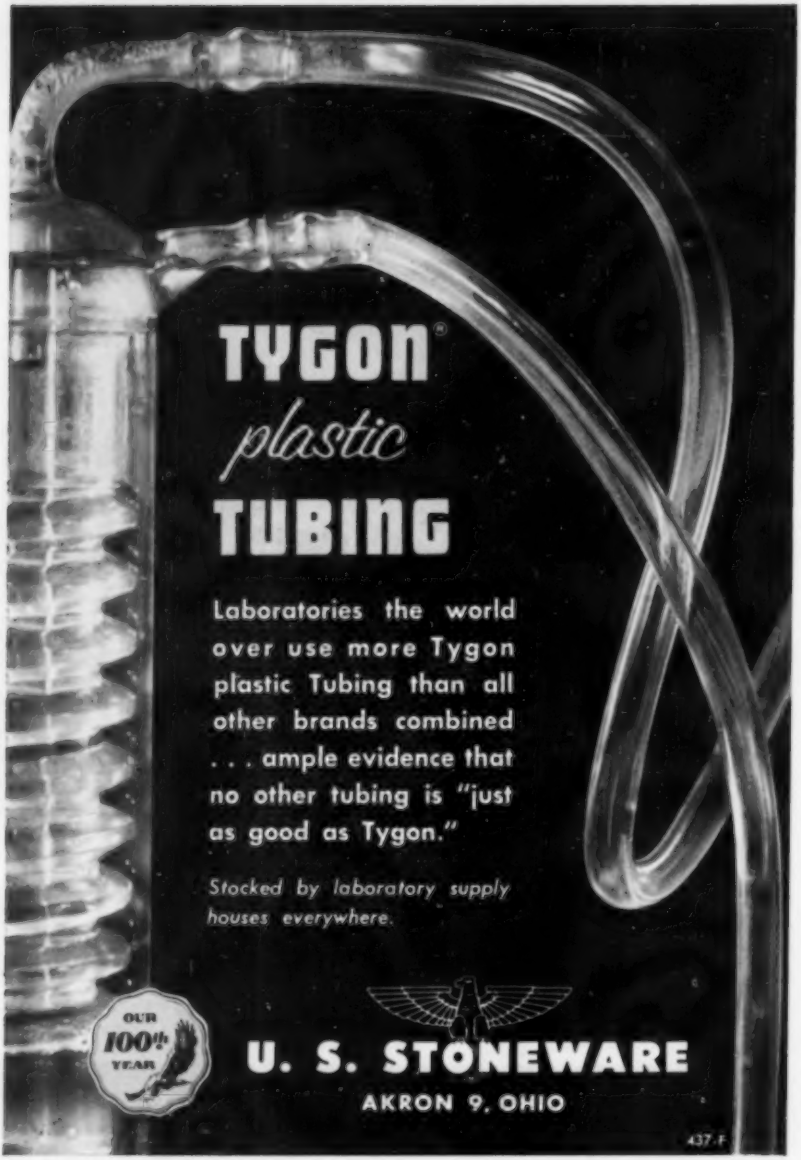
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